Beyond Development: Navigating Stakeholder Friction in Legacy Software Modernization

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Abstract

Software modernization is often framed as a purely technical challenge, yet its success depends on managing the socio-technical friction arising from replacing operational legacy systems. We present a Systematic Mapping Study (SMS) complemented by practitioner interviews, identifying three categories of modernization-specific challenges and mapping them to four families of engagement strategies. This shows that obstacles such as knowledge debt, psychological resistance, and miscommunication demand interventions beyond standard software engineering practice.
Keywords: Software Modernization, Stakeholder Engagement, Legacy Systems, Socio-Technical Gap, Systematic Mapping Study.

1 Introduction

Software modernization replaces business-critical legacy systems rather than creating new value [3]. This creates a *socio-technical gap*: stakeholders must accept uncertainty and trust a system whose benefits are often intangible [6]. While technical migration is well-researched [10], the human factor remains underexplored [3, 5]. General frameworks like TOGAF [12] and requirements-engineering SLRs [1, 11] lack the modernization-specific focus (e.g., knowledge debt and justifying change to functional systems) needed for legacy transitions. We fill this gap by mapping modernization-specific challenges to targeted strategies, derived from a 91-paper SMS and practitioner interviews.

2 Study Design

Our SMS covered peer-reviewed, English-language articles (2014-2024) across six major databases using modernization and stakeholder keywords. From 1,149 initial results, duplicate removal and title-abstract screening yielded 95 papers, with 91 included after full-text review. Papers were coded for challenges, solutions, roles, viewpoints, and engagement importance.

Five semi-structured interviews with industry practitioners (CTO, product manager, three developers) triangulated the findings via Likert-scale ratings and strategy effectiveness discussions. Full data is available in our reproducibility package [1].

3 Findings

Our analysis identified three categories of modernization-specific challenges and four corresponding engagement strategy families.

3.1 Modernization-Specific Challenges

Technical Challenges include missing documentation, monolithic complexity [10], and technical debt, which inflate costs and fuel managerial reluctance [6].

Stakeholder Engagement Challenges encompass the core frictions: *knowledge debt* from missing original developers [13], *psychological resistance* and fear of obsolescence [9], and *miscommunication* when justifying intangible benefits.

Process and Operational Challenges involve high costs, uncertain ROI [2], and skilled personnel shortages.

3.2 Engagement Strategies

From the literature we distilled four families of engagement strategies. Table 1 maps the identified challenges to applicable strategies and reports how many of the 91 primary studies mention each challenge (N).

Collaboration and Feedback (CF) includes participatory workshops for business-objective elicitation [4], socio-technical models, and *internal debt stories* translating technical debt into business language [7]. *Conflict Management* (CM) uses prioritisation like AHP-based preference elicitation [8]. *Business Alignment* (BA) anchors modernization in business cases, while *Education and Training* (ET) addresses resistance by transforming sceptics into change agents.

[1] https://anonymous.4open.science/r/Stakeholder-Engagement-in-Modernization-8873

Challenge	N	Strategies
Knowledge debt	13	CF
Miscommunication	6	CF, CM
Stakeholder diversity	9	CF, CM, BA
Internal resistance	8	CM, BA, ET
Job insecurity	3	ET
User resistance	2	CF
Uncertain ROI	3	CF

Table 1: Challenges mapped to engagement strategies with occurrence frequency (N) across the 91 primary studies. CF = Collaboration & Feedback, CM = Conflict Management, BA = Business Alignment, ET = Education & Training.

Practitioner interviews provided three distinct insights. First, *data abstraction* is vital for bridging the complexity-value gap, as technical teams often overrate technical upgrades. Second, organizational resistance is perceived more strongly at operational levels than strategic ones. Third, ET strategies are more critical in modernization than in greenfield projects due to legacy workflow persistence. The product manager also identified *change management* as a missing dimension.

4 Conclusion

This paper distilled the results of a systematic mapping study of 91 publications and five practitioner interviews into a challenge-strategy mapping for stakeholder engagement. Modernization constitutes a distinct socio-technical transition characterized by knowledge debt, psychological resistance, and the burden of justifying change to functional legacy systems. Unlike general stakeholder management frameworks [12], our mapping targets frictions unique to legacy transitions, such as the persistence of outdated workflows. These findings can inform architectural decision-making by revealing which modernization paths are organizationally feasible rather than merely technically sound. Future work should consolidate these strategies into a comprehensive practitioner framework and examine how the shift toward AI-assisted modernization affects these socio-technical frictions.

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